**IN THE CLAIMS:**

1. (Original) An apparatus to treat an influent solution comprising ions to obtain a selectable ion concentration in a resultant effluent solution, the apparatus comprising:

(a) an electrochemical cell comprising:

(i) a housing comprising first and second electrodes;

(ii) a water-splitting ion exchange membrane between the first and second electrodes, the membrane comprising (i) a cation exchange surface facing the first electrode, and (ii) an anion exchange surface facing the second electrode; and

(iii) an influent solution inlet and an effluent solution outlet with a solution channel therebetween, the solution channel allowing the influent solution to flow past both the anion and cation exchange surfaces of the water-splitting ion exchange membrane and thereby form the effluent solution; and

(b) a variable voltage supply capable of maintaining the first and second electrodes at a plurality of voltage levels during an ion exchange stage.

2. (Original) An apparatus according to claim 1 wherein the voltage levels are time averaged voltage levels.

3. (Original) An apparatus according to claim 2 wherein the voltage levels comprise a range of voltage levels that are selected to maintain a predefined ion concentration range in the effluent solution.

4. (Original) An apparatus according to claim 2 wherein the time averaged voltage levels each have a different magnitude but substantially the same polarity.

5. (Original) An apparatus according to claim 2 wherein the ion exchange stage comprises an ion removal step.

6. (Original) An apparatus according to claim 2 wherein the ion exchange stage comprises an ion rejection step.

7. (Original) An apparatus according to claim 1 wherein the variable voltage supply is a phase control voltage supply.

8. (Original) An apparatus according to claim 1 wherein the variable voltage supply provides a variable magnitude pulsed voltage.

9. (Original) An apparatus according to claim 1 wherein the variable voltage supply comprises a switching voltage supply with pulse width modulation.

10. (Original) An apparatus according to claim 1 wherein the variable voltage supply provides a fixed magnitude pulsed voltage.

11. (Original) An apparatus according to claim 1 comprising a voltmeter to measure the voltage bias in the cell and generate a voltage signal, an ammeter to measure the current in the cell and generate a current signal, and a controller which determines the ion concentration in the solution from the ratio of the voltage and current signals and sends a control signal to the variable voltage supply to adjust the voltage level applied to the electrodes in response to the ion concentration.

12. (Original) An apparatus according to claim 1 comprising:

(1) an ion sensor to (i) measure an ion concentration of the influent solution, at least partially treated solution, or effluent solution, and (ii) generate an ion concentration signal, and

(2) a controller to receive the ion concentration signal and send a control signal to the variable voltage supply to adjust the voltage level in response to the ion concentration signal.

13. (Original) An apparatus to treat an influent solution comprising ions to obtain a selectable ion concentration in an effluent solution, the apparatus comprising:

(a) an electrochemical cell comprising:

(i) a housing comprising first and second electrodes;

(ii) a water-splitting ion exchange membrane positioned between the first and second electrodes, the membrane comprising (i) a cation exchange surface facing the first electrode, and (ii) an anion exchange surface facing the second electrode; and

(iii) an influent solution inlet and an effluent solution outlet with a solution channel therebetween, the solution channel allowing the influent solution to flow past both the anion and cation exchange surfaces of the water-splitting ion exchange membrane and thereby form the effluent solution;

(b) an ion sensor to measure an ion concentration in the influent solution, at least partially influent solution, or effluent solution, and generate an ion concentration signal;

(c) a variable voltage supply to maintain the first and second electrodes at a plurality of different voltage levels; and

(d) a controller to receive the ion concentration signal from the ion meter and send a control signal to the variable voltage supply to adjust the voltage level applied to the first and second electrodes in response to the ion concentration signal to achieve a predefined ion concentration range in the effluent solution.

14. (Original) An apparatus according to claim 13 wherein the variable voltage supply is capable of providing voltage levels that are time averaged voltage levels during the ion exchange stage.

15. (Original) A method of treating an influent solution comprising ions to control the concentration of ions in an effluent solution, the method comprising:

(a) flowing the influent solution past both anion and cation exchange surfaces of a water-splitting ion exchange membrane to form the effluent solution;

(b) maintaining a time averaged electric field across the cation and anion exchange surfaces of the water-splitting membrane; and

(c) varying the strength of the time averaged electric field to control the ion concentration of the effluent solution.

16. (Original) A method according to claim 15 wherein the strength of the time averaged electric field is varied to achieve a predefined ion concentration range in the effluent solution.

17. (Original) A method according to claim 15 comprising measuring an ion concentration of the at least partially treated influent solution and varying the strength of the time averaged electric field in response to the measured ion concentration.

18. (Original) A method according to claim 15 comprising varying the strength of the time averaged electric field by varying the time-averaged voltage level of a variable-magnitude pulsed voltage applied to electrodes about the cation and anion exchange surfaces of the water-splitting membrane.

19. (Original) A method according to claim 15 comprising varying the strength of the time averaged electric field by varying the duty cycle of a fixed-magnitude pulsed voltage level applied to electrodes about the cation and anion exchange surfaces of the water-splitting membrane.

20. (Original) A method according to claim 15 comprising measuring the voltage and current through the solution and water-splitting membrane and determining an ion concentration in the solution from the ratio of the voltage and current measurements

Please add the following claims:

21. (New) An apparatus to treat a solution comprising ions, the apparatus comprising:

(a) an electrochemical cell comprising a housing with first and second electrodes, an ion exchange membrane between the electrodes, and a solution channel;

(b) a voltage supply to provide a voltage across the first and second electrodes;

(c) a flow control device to control the flow of solution through the solution channel of the cell; and

(d) a controller to control the voltage supply and flow control device to:

(i) in an ion removal step, maintain the first electrode as the positive electrode and the second electrode as the negative electrode relative to the first electrode, and flow solution through the solution channel; and

(ii) in an ion rejection step, maintain the first electrode as the negative electrode and the second electrode as the positive electrode relative to the first electrode, and reverse the flow direction of the solution through the solution channel.

22. (New) An apparatus according to claim 21 wherein in the ion rejection step, the controller reverses the polarity of the first and second electrodes relative to the polarity of the electrodes in the ion removable step.

23. (New) An apparatus according to claim 21 wherein the voltage supply applies a time modulated voltage to the first and second electrodes.

24. (New) An apparatus according to claim 23 wherein in the ion removal step, the voltage supply applies a first time modulated voltage to the electrodes, and in the ion rejection step, the voltage supply applies a second time modulated voltage to the electrodes, and wherein the first time modulated voltage has a first magnitude and the second time modulated voltage has a different magnitude than the first magnitude.

25. (New) An apparatus according to claim 21 wherein in the ion removal or rejection step, the voltage supply applies to the first and second electrodes a constant voltage level or a pulsed voltage level.

26. (New) An apparatus according to claim 21 wherein the voltage supply applies a pulsed voltage level having one or more duty cycles.

27. (New) An apparatus according to claim 21 wherein the voltage supply includes a polarity switch to switch the polarity of the voltage applied to the first and second electrodes.

28. (New) An apparatus according to claim 27 wherein the voltage supply provides a variable DC voltage by half-wave or full-wave rectification of an AC voltage.

29. (New) An apparatus according to claim 21 further comprising an ion sensor to (i) measure an ion concentration of the influent solution, at least partially treated solution, or effluent solution, and (ii) generate an ion concentration signal, and

wherein the controller receives the ion concentration signal and sends a control signal to the voltage supply to adjust the voltage applied to the electrodes in response to the ion concentration signal.

30. (New) An apparatus according to claim 21 wherein the membrane comprises a cation exchange surface facing the first electrode and an anion exchange surface facing the second electrode, and the solution channel allows the solution to flow past both the anion and cation exchange surfaces of the ion exchange membrane.

31. (New) An apparatus according to claim 21 wherein the electrochemical cell comprises an influent solution inlet abutting the first electrode and effluent solution outlet abutting the second electrode.

32. (New) An apparatus according to claim 31 wherein in the ion removal step the controller operates the flow control device to supply the solution through the influent solution orifice, and in the ion rejection step the controller operates the flow control device to supply the solution through the effluent solution inlet.

33. **(New)** A method of treating a solution comprising ions in an electrochemical cell comprising a housing comprising first and second electrodes, an ion exchange membrane between the electrodes, and a solution channel, the method comprising:

(a) in an ion removal step, maintaining the first electrode as the positive electrode and the second electrode as the negative electrode relative to the first electrode, and flowing solution through the solution channel; and

(b) in an ion rejection step, maintaining the first electrode as the negative electrode and the second electrode as the positive electrode relative to the first electrode, and reversing the flow direction of the solution through the solution channel.

34. (New) A method according to claim 31 wherein the ion rejection step comprises reversing the polarity of the first and second electrodes.

35. (New) A method according to claim 31 comprising applying a time modulated voltage to the first and second electrodes.

36. (New) A method according to claim 35 comprising measuring an ion concentration of the at least partially treated influent solution and varying the magnitude of the time modulated voltage in response to the measured ion concentration.

37. (New) A method according to claim 31 comprising applying to the first and second electrodes a constant voltage level or a pulsed voltage level.

38. (New) A method according to claim 37 comprising applying a pulsed voltage level having one or more duty cycles.

39. (New) An apparatus to treat a solution comprising ions, the apparatus comprising:

(a) an electrochemical cell comprising a housing with first and second electrodes, an ion exchange membrane between the electrodes, and a solution channel;

(b) a variable voltage supply to provide a voltage across the first and second electrodes; and

(c) a controller to control the variable voltage supply and flow control device to:

(i) in an ion removal step, flow solution through the solution channel while applying a voltage to the first and second electrodes to deionize the solution; and

(ii) in an ion rejection step, regenerate the ion exchange membrane by flowing solution through the solution channel while (1) in a first regeneration step, supply a first voltage to the electrodes of the cell for a time period, and (2) in a second regeneration step, supply a second voltage to the electrodes of the cell for a time period, the second voltage being a different voltage than the first voltage.

40. (New) An apparatus according to claim 39 wherein the first and second voltages have different magnitudes.

41. (New) An apparatus according to claim 40 wherein the first and second voltages have negative values relative to the voltage applied in the ion removal step.

42. (New) An apparatus according to claim 39 wherein the first and second voltages are each a fixed constant voltage level or fixed pulsed voltage level.

43. (New) An apparatus according to claim 39 wherein the first voltage comprises a pulsed voltage having a first duty cycle and the second voltage comprises a pulsed voltage having a second duty cycle.

44. (New) An apparatus according to claim 43 wherein the first voltage is provided over a first time period and the second voltage is provided over a second time period that is a different time period than the first time period.

45. (New) An apparatus according to claim 43 wherein in the ion rejection step, the controller further controls the variable voltage supply to provide a third voltage over a time period.

46. (New) An apparatus according to claim 39 wherein the voltage supply includes a polarity switch to switch the polarity of the voltage applied to the first and second electrodes in the ion rejection stage relative to the polarity applied in the ion removal stage.

47. (New) An apparatus according to claim 39 further comprising a flow control device to control the flow of solution, and wherein in the ion rejection stage, the controller controls the flow control device to reverse the flow direction of the solution through the solution channel relative to the flow direction in the ion removal stage.

48. (New) An apparatus according to claim 39 further comprising an ion sensor to measure an ion concentration of the regenerated waste solution and generate an ion concentration signal, and wherein the controller receives the ion concentration signal and sends a control signal to the variable voltage supply to adjust the voltage applied to the first and second electrodes in response to the ion concentration signal.

49. (New) A method of treating a solution comprising ions in an electrochemical cell comprising an ion exchange membrane between electrodes, the method comprising:

(a) in an ion removal step, flowing solution into the cell while applying a voltage to the first and second electrodes to deionize the solution; and

(b) in an ion rejection step, regenerating the ion exchange membrane by flowing solution through the cell while (1) in a first regeneration step, supplying a first voltage to the electrodes for a time period, and (2) in a second regeneration step, supply a second voltage to the electrodes for a time period, the second voltage being a different voltage than the first voltage.

50. (New) A method according to claim 49 comprising supplying first and second voltages having different magnitudes.

51. (New) A method according to claim 49 comprising supplying first and second voltages having negative values relative to the voltage applied in the ion removal step.

52. (New) A method according to claim 49 comprising supplying first and second voltages that are each a fixed constant voltage level or fixed pulsed voltage level.

53. (New) A method according to claim 49 comprising supplying a first voltage comprising a pulsed voltage having a first duty cycle and the second voltage comprising a pulsed voltage having a second duty cycle.

54. (New) A method according to claim 49 comprising supplying a first voltage over a first time period and a second voltage over a second time period that is a different time period than the first time period.

55. (New) A method according to claim 49 comprising supplying a third voltage over a time period.

56. (New) A method according to claim 49 comprising switching the polarity of the voltage applied to the first and second electrodes in the ion rejection stage relative to the polarity applied in the ion removal stage.

57. (New) A method according to claim 49 comprising reversing the flow direction of the solution in the cell in the ion rejection stage relative to the flow direction in the ion removal stage.

58. (New) A method according to claim 49 comprising measuring an ion concentration of the regenerated waste solution, generating an ion concentration signal, and adjusting the first or second voltages supplied to the first and second electrodes in response to the ion concentration signal.